The Flaw in Relying on Separate Growth and Discount Rates to Estimate the Expected Present Value of a Future Loss

David G. Tucek

Value Economics, LLC
13024 Vinson Court
St. Louis, MO 63043

Cell: 314-440-4925

David.Tucek@valueeconomics.com

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Abstract

This paper demonstrates an inherent flaw in using separate growth and discount rates to estimate the expected present value of a future loss. The argument relies on two axiomatic propositions:

(1) No one knows what a plaintiff's or decedent's future earnings or household services would have been, or what the plaintiff's future medical care costs will be; and

(2) The investment return a plaintiff will receive in the future is unknown.

These propositions lead directly to the conclusion that the best anyone can do is estimate the expected present value of a future loss. This conclusion, in conjunction with the premise that growth and interest rates are correlated, lead to the inherent flaw in the use of separate growth and discount rates to estimate the expected present value of a future loss – namely, that the resulting present value calculation is biased. Moreover, if growth and interest rates are positively correlated, the bias is positive and the resulting present value is overstated.

Introduction

Most, though not all, forensic economists fall into one of two groups: (1) those who rely on a historical or forecasted net discount rate (NDR) to calculate the present value of future lost earnings, household services or medical care costs; and (2) those who rely on average historical or forecasted growth rates to project losses into the future and current interest rates to discount the future losses to the present.[1] This dichotomy has existed almost since forensic economics began to be established as a separate/distinct

[1] Included in the first group are those forensic economists who rely on historical average values of both growth and discount rates calculated over the same time period, since this approach is mathematically equivalent to use of a historical NDR.

discipline. For example, Nowak (1991) concluded that a fixed net discount rate cannot be used as a general rule for calculating monetary awards, while Pelaez (1991) held that interest rates, wage growth, and inflation are unit root processes making long-run forecasts difficult and that the ratio of the earnings growth rate to the discount rate – the net discount rate – was stationary. More recently, Baumann and Schap (2014 and 2015) have presented evidence concerning the stationarity of both earnings and medical NDRs, while Krueger (2016) has (prematurely) retired the NDR to the dust bin of failed methodologies. Even though it is almost certain that the disagreement between these two groups will never be resolved, this paper demonstrates an inherent flaw in using separate growth and discount rates to estimate the expected present value of a future loss.

Foundational Propositions

The argument presented below rests on two axiomatic propositions:

(1) No one knows what the plaintiff's or decedent's future earnings or household services would have been, or what the plaintiff's future medical care costs will be; and

(2) The investment return a plaintiff will receive in the future is unknown.

Proposition 1 is clearly self-evident. Future earnings will depend not only on the growth in some base or starting level of earnings, but also on the occurrence or avoidance of the risk that the plaintiff might die, not be an active labor force participant even if alive, or that the plaintiff might be unemployed even if active in the labor force. Future household services will depend on the growth in some starting level of services and on changes in the plaintiff's or decedent's age and household composition, and on their mortality and morbidity risk. Likewise, future medical costs depend not only on the growth rate used to project those costs, but also on the plaintiff's medical progress and mortality risk.

Proposition 2 is also self-evident. Even if we had perfect foresight concerning the total future returns of all possible investment instruments, we could not know what the plaintiff's future total returns will be since we do not know how any award or settlement amount will be invested initially. Indeed, even if we knew the composition of the initial investment portfolio, we still could not know what the plaintiff's future total returns will be since we do not know how that portfolio will change as time passes. This is true even if we restrict the portfolio choice to Treasury securities in order to comply with *Pfeifer's* requirement that "the discount rate should not reflect the market's premium for investors who are willing to accept some risk of default", since we have no way of knowing at what rate future coupon payments will be invested.[2]

It is clear from the above that both the future losses and the plaintiff's future total returns are random variables. That is, they are variables whose values depend on outcomes of random phenomena. It follows then, that the present value of the future losses is also a random variable and that the best anyone can do is to estimate the expected present value of a future loss – in order to do better than estimating the expected present value of a future loss one would, at a minimum, have to know what the plaintiff's or decedent's future would have been but for the event that gave rise to the tort. Clearly, no one knows this.

The Inherent Flaw

We can state the above conclusion more formally by letting L_t be the future loss in loss year t, and K_t be the corresponding present value factor (a function of the discount rate) constructed in a way such that the present value, P_t, of L_t equals the product $K_t \cdot L_t$. It follows then that:

(1) $E(P_i) = E(K_t \cdot L_t)$ where E( ) denotes the expected value. From this, it follows that:

[2] Some forensic economists advocate the use of zero-coupon bonds in response to this observation. In doing so, they are ignoring the adverse tax consequences of holding such securities in a taxable portfolio.

(2) $E(P_t) = E(K_t) \cdot E(L_t) + Cov(K_t,L_t)$ where Cov( ) denotes the covariance.[3]

In other words, any estimate based only on the individual values of K_t and L_t will be biased downwards if the covariance between K_t and L_t is positive, and biased upwards if it is negative. Because L_t is a function of future growth in wages, household services, or medical costs, and because economic growth and interest rates are positively correlated, the covariance between L_t and the discount rate will be positive. There is theoretical and historical support for the positive correlation between growth and interest rates.

First, interest rates determine the quantity of capital supplied (savings) and the quantity of capital demanded (investment), which in turn determine expected future economic growth in the long run. Consequently, the interest and expected growth rates are positively correlated. ***Because K_t is inversely related to the discount rate***, discounting with separate interest and growth rates means that if L_t is a function of future growth in wages, household services or medical costs, the covariance between K_t and L_t will be negative and the estimated value of P_t based on their individual values will be biased upwards.[4]

Second, a review of the historical relationship between interest rates and growth rates reveals that, in a preponderance of instances, the measures are positively correlated. This is shown in Table 1 below. In this table, the 10-year log-linear trendline growth in various measures used to model the growth in earnings, household services and life care plan components is compared to the 10-year Treasury rate both at the end and the start of the period over which the trendline is calculated.[5] In this table, the growth rate is calculated over the period from 1980 through mid-2025 whenever the available data exist to permit this. Thus, for most of the CPI (Consumer Price Index) measures, the first trendline growth rate is calculated using monthly data from February 1970 through January 1980, linked with the corresponding 10-year Treasury rates at the end and start of this period. By comparison, for the ECI (Employment Cost Index) the first observation corresponds to 2001-Q1, and the first trendline growth rate is calculated using quarterly data from 2001-Q1 to 2010-Q4. Again, this growth rate is linked with the corresponding 10-year Treasury rates at the end and start of this period, calculated as the average over each quarter. In Table 1, negative sample covariances and correlations appear in bold, red, font. Shaded cells denote instances in which the sample correlation coefficient is not significantly different from zero at a 95 percent level of confidence.

Finally, a comparison of the 10-year trendline growth rate (g) for each index in Table 1 over periods from January 1980 through June 2025 with the 10-year Treasury rate, shows that the covariance between $(1+g)^t$ and K_t is negative for t=1,100 for the preponderance of the indices in Table 1. Additionally, the

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[3] For any two random variables, X and Y,

$$Cov(X,Y) = E[(X-E[X])\cdot(Y-E[Y])] = E[X\cdot Y - E[X]\cdot Y - X\cdot E[Y] + E[X]\cdot E[Y]]$$

$$= E[X\cdot Y] - E[X]\cdot E[Y] - E[X]\cdot E[Y] + E[X]\cdot E[Y]$$

$$= E[X\cdot Y] - E[X]\cdot E[Y] \text{ which gives:}$$

$E[X\cdot Y]=E[X]\cdot E[Y]+Cov(X,Y)$ or the result relied on in (2) above with $X= K_t$ and $Y= L_t$.

[4] If K_t is expressed on a net discount rate basis, and if the NDR is stationary, L_t will not be a function of future economic growth or inflation and $Cov(K_t,L_t)$ will equal zero. Consequently, use of an NDR eliminates the bias in the estimated value of P_t. Note that it is necessary to test the NDR for stationarity because it is a forecast of the difference between the growth rate and the discount rate. Clearly, if the NDR is not expected to be stable about some mean, but is instead nonstationary, a forecast based on its mean will not be meaningful. Put differently, $E(K_t)$ in (2) above would not be a constant.

[5] Most reports that I have seen would rely on the Treasury rate as of the end of the period over which the growth rate is calculated. However, Ed Foster (Foster, 2015) has suggested that the interest rate be measured at the start of the period over which the growth rate is calculated. This is because interest rates reflect expectations of *future* growth, not *past* growth.

correlation between the $(1+g)^t$ and K_t is negative and statistically significant from zero at a 95 percent level of confidence. The exceptions to this pattern are the CPI for nonprescription drugs through March 2023, which exhibited negative growth rates over the period, and the CPI for medical equipment and supplies which had a positive correlation from January 2021 through February 2023.

Conclusion

The main conclusion of this paper is that using separate growth and discount rates to estimate the expected present value of the plaintiff's future losses produces a biased estimate of the expected present value of the future losses. Since the plaintiff's future losses and investment returns depend on the outcome of random phenomena, the losses and the investment returns are random variables and the expected value, $E(P_t)$, can be shown to be equal to $E(K_t) \cdot E(L_t) + Cov(K_t,L_t)$ where K_t, L_t and Cov( ) are defined above. Economic theory and actual data establish that growth and interest rates are positively correlated and, because K_t is inversely related to the discount rate, the estimated value of P_t will be biased upwards if it is based on individual values of K_t and L_t. If K_t is expressed on a net discount rate basis, ***and if the NDR is stationary***, L_t will not be a function of future economic growth or inflation, and $Cov(K_t,L_t)$ will equal zero. Consequently, use of an NDR eliminates the bias in the estimated value of P_t. The stationarity requirement is not trivial and, as illustrated in the attached appendix, requires more than the completion of one or two statistical tests.

Table 1 - Summary of Sample Covariances and Correlations Between 10-Year Treasury Rates and Selected Growth Measures

		Based On End-of-Period 10-Year Treasury				Based On Start-of-Period 10-Year Treasury			
Growth Measure	**Sample Period**	**Cov**	**Correl**	**N**	**t-Stat**	**Cov**	**Correl**	**N**	**t-Stat**
Total Compensation ECI for All Private Industry Workers	2010Q4 to 2025Q2	0.000026	0.677995	59	6.964	**-0.000018**	**-0.425799**	59	-3.553
Wages and Salaries ECI for All Private Industry Workers	2010Q4 to 2025Q2	0.000032	0.680811	59	7.017	**-0.000033**	**-0.642502**	59	-6.330
Total Benefits ECI for Private Industry Workers in Service Providing Industries	2010Q4 to 2025Q2	0.000014	0.339825	59	2.728	0.000016	0.356462	59	2.880
Average Weekly Earnings of Production and Nonsupervisory Employees	01-1980 to 06-2025	0.000391	0.833414	546	35.173	0.000026	0.062690	546	1.465
CPI for Physicians' Services	01-1980 to 06-2025	0.000863	0.923879	546	56.308	0.000525	0.637107	546	19.279
CPI for Dental Services	01-1980 to 06-2025	0.000583	0.887357	546	44.887	0.000388	0.670874	546	21.100
CPI for Services by oOher Medical Professionals	11-1996 to 06-2025	0.000072	0.662745	344	16.367	0.000130	0.839197	344	28.538
CPI for Eyeglasses and Eye Care	11-1996 to 06-2025	0.000074	0.783011	344	23.280	0.000117	0.860264	344	31.204
CPI for Prescription Drugs	01-1980 to 06-2025	0.000631	0.703857	546	23.111	0.000607	0.767311	546	27.908
CPI for Nonprescription Drugs	11-2019 to 06-2025	0.000066	0.788604	68	10.419	**-0.000008**	**-0.207397**	68	-1.722
CPI for Medical Equipment and Supplies	11-2019 to 06-2025	0.000036	0.611065	68	6.271	0.000002	0.057850	68	0.471
CPI for Hospital Services	11-2006 to 06-2025	**-0.000001**	**-0.009706**	224	-0.145	0.000125	0.824170	224	21.683
CPI for Inpatient Hospital Services	11-2006 to 06-2025	**-0.000014**	**-0.109282**	224	-1.638	0.000137	0.824805	224	21.735
CPI for Outpatient Hospital Services	11-1996 to 06-2025	0.000088	0.437632	344	9.001	0.000219	0.760179	344	21.637

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Appendix

Addressing the stationarity of a given NDR requires more than the completion of one or two statistical tests. A first step is to look at the NDR's history through time. For the NDRs based on the CPI for physicians' services, this is done in Figures 1A and 1B. In both figures, the NDR is based on the 10-year log-linear trendline growth in the physicians' services CPI. In Figure 1A, the NDR is based on the end-of-period 10-year Treasury rate, while for Figure 1B it is based on the start-of-period 10-year Treasury rate. Figure 1A supports the conclusion that the NDR is stationary while Figure 1B does not. For both NDR measures the sample covariance and correlation between the 10-year growth rate and corresponding Treasury rate is reported for the 1979M12 to 2025M06 and the 1983M01 to 2025M06 time periods. This latter time period was chosen to eliminate the period in which the Federal Reserve attempted to target growth in monetary aggregates rather than the Federal Funds rate. For both periods, the correlation is significant and positive, indicating the use of separate growth and discount rates to calculate the expected present value of future losses results in estimates that are biased upwards.

The second step is to examine the NDR's correllogram – if the sample autocorrelations decay to zero, then the conclusion that the NDR is stationary is supported. (See Box and Jenkins (1971), Nielsen (2006) and Enders (2010) for examples of autocorrelation functions for stationary and non-stationary series.) Figure 2A depicts the correllograms for the physicians' services NDR based on the end-of-period 10-year Treasury rate for sample periods starting in 1979M12 and 1983M01, along with the 95 percent confidence levels. For the first sample period, the sample autocorrelations are not significantly different from zero after 19 months, giving weak support to the conclusion that the NDR is stationary. The support is much stronger for the second sample period – the decay to zero occurs earlier and is much more pronounced. Figure 2B depicts the correllograms for the physicians' services NDR based on the start-of-period 10-year Treasury rate for the same two sample periods. In both instances, it is clear that the NDR is not stationary.

The third step is to conduct formal statistical tests to assist in deciding whether a particular NDR is stationary. There are multiple statistical tests available to a forensic economist in making this decision. These tests differ both in the assumption made concerning the underlying process and in the specification of the null hypothesis. For example, the augmented Dickey-Fuller (ADF) test tests the null hypothesis that $\rho=1$ in the equation $Y_t = \alpha + \rho \cdot Y_{t-1} + \sum_{j=1}^{k} \lambda_j \Delta Y_{t-j} + \varepsilon_t$ where Y is the NDR, Δ is the first difference operator, and ε_t is a random error term. By comparison, the Phillips-Perron (PP) test tests the same null hypothesis for the equation $Y_t = \alpha + \rho \cdot Y_{t-1} + \varepsilon_t$ but corrects for autocorrelation and heteroscedasticity in the error term. For both the ADF and PP tests, rejecting the null that $\rho=1$ supports the conclusion that Y is stationary.

The Kwiatkowski, Phillips, Schmidt and Shinn (KPSS) test tests the null hypothesis that the series of interest is stationary. Consequently, being unable to reject the null provides support for the conclusion that the NDR in question is stationary. The KPSS test results provide four reference points of how low the confidence level must be in order to be able to reject the null:

(1) greater than 99 percent;

(2) between 95 and 99 percent;

(3) between 90 and 95 percent; and

(4) less than 90 percent.

The strongest support for the stationary conclusion is given by the last of these four reference points.

For a given set of observations, it may well be that different stationarity tests will lead to a different conclusion with regard to the stationarity of the NDR. Consequently, the forensic economist should not rely on the results of a single test but instead be informed by the results from several tests. With respect to the NDRs in Figure 1A, the stationarity issue was examined using four formal stationarity tests: the ADF test, two PP tests and the KPSS test.[1]

The results of these tests for the Figure 1A NDR are summarized below:

Physicians' Services NDR

Based on End-of-Period 10-Year Treasury

Sample Period	Conf Level for ADF Test	Conf Level for PP Test (Bartlett Kernel)	Conf Level for PP Test (AR OLS)	KPSS H_0: NDR is stationary
1979M12 2025M06	99%	96%	94%	$0.01<p<0.05$
1983M01 2025M06	94%	92%	94%	$p>0.10$

These results support the conclusion that the physicians' services NDR based on the end-of-period 10-year Treasury rate is stationary across the board, with the support being strongest for the 1979M12 2025M06 sample period.

The corresponding results for the physicians' services NDR based on the start-of-period 10-year Treasury rate appear below:

Physicians' Services NDR

Based on Start-of-Period 10-Year Treasury

Sample Period	Conf Level for ADF Test	Conf Level for PP Test (Bartlett Kernel)	Conf Level for PP Test (AR OLS)	KPSS H_0: NDR is stationary
1979M12 2025M06	68%	69%	64%	$0.01<p<0.05$
1983M01 2025M06	93%	94%	93%	$0.05<p<0.10$

Note that the results for the slightly shorter sample period support the conclusion that the NDR is stationary. This underscores the need for visual review of the data and to not rely solely on one or more formal stationarity tests.[2]

Finally, the ordinary-least-squares estimate of ρ and its standard error in the equation $Y_t = \alpha + \rho \cdot Y_{t-1} + \varepsilon_t$, with both the estimate of ρ and its standard error corrected for bias, was examined. The difference between one and the absolute value of the corrected estimate of ρ, measured in terms of its corrected standard error, informs the issue of the NDR's stationarity – the greater the distance, the greater the

[1] All four tests were performed using version 11 of E-Views. The difference between the two PP tests lies in the technique to estimate the distribution of the error term in the PP test equation. The first PP test utilized E-Views' Bartlett kernel default, while the second utilized an autoregressive specification for the error term.

[2] I have seen reports in which the FE relied on a single PP test to determine whether a given series was stationary. While this allowed the FE to apply the test and subsequent calculations to multiple series via a SAS macro, doing so runs the risk of either overlooking a stationary series or concluding a series was stationary when other evidence suggested it was not.

support for the conclusion that the NDR is stationary.[3] For the physicians' services NDR based on the end-of-period 10-year Treasury rate, the resulting estimate of ρ was 1.70 and 1.37 corrected standard deviations from one for the two sample periods, respectively. These results provide strong support for the conclusion that the NDR is stationary. For the physicians' services NDR based on the start-of-period 10-year Treasury rate, the resulting estimate of ρ was 0.30 and 1.03 corrected standard deviations from one for the two sample periods, respectively. These results only provide weak support for the conclusion that the NDR is stationary.

The above analysis supports the conclusion that the physicians' services NDR based on the end-of-period 10-year Treasury rate is stationary while the NDR based on the start-of-period 10-year Treasury rate is not. Reaching the conclusion that the former NDR is stationary still leaves unanswered the question of what NDR value to be used and how its use is to be implemented. The last observation of the NDR based on the end-of-period 10-year Treasury rate equals 2.90 percent, while the mean values for the two sample periods are 0.86 and 0.67 percent, respectively. Because it is not reasonable to assume that the NDR will immediately fall by 170 to 220 basis points, some means of transitioning from the last known value and the long run NDR is needed.

One approach that I have used is to estimate an autoregressive model to forecast the NDR from the immediate past into the future. That is, the NDR is expressed as a function of one or more autoregessive terms, with the intercept being the estimate of the long run value. A summary of the results of this analysis for the physicians' services NDR based on the end-of-period 10-year Treasury rate and the 1979M12 to 2025M06 sample period is presented below:

Physicians' Services NDR

Based on End-of-Period 10-Year Treasury

(Sample 1979M12 2025M06 -- 547 Observations)

	Adj R^2	DW Statistic	LR NDR	AR(1)	AR(2)	AR(3)	AR(12)
(1)	0.9484	1.368	1.07%	0.9751			
			(2.05)	(138.46)			
(2)	0.9537	1.875	0.96%	1.2894	-0.3233		
			(2.50)	(45.35)	(11.95)		
(3)	0.9553	1.975	1.04%	1.3503	-0.5720	0.1951	
			(2.22)	(44.88)	(12.44)	(6.64)	
(4)	0.9557	1.980	0.94%	1.3483	-0.5793	0.2253	-0.0312
			(2.68)	(44.27)	(12.24)	(6.74)	(2.93)

Comparable results based on the 1983M01 to 2025M06 sample period appear below:

[3] Orcutt and Winokur (1969) provide estimates of ρ and its variance that correct for the bias in the OLS estimates. In the results presented below, the estimated values of ρ were positive and less than one in all cases. While an absolute value less than one is a requirement for a stationary series, in and of itself, it does not add support to the conclusion that the NDR is stationary. However, a large distance between one and the absolute value of the corrected estimate of ρ, measured in terms of its corrected standard error, does add support to the conclusion that the NDR is stationary.

Physicians' Services NDR

Based on End-of-Period 10-Year Treasury

(Sample 1983M01 2025M06 -- 510 Observations)

	Adj R^2	DW Statistic	LR NDR	AR(1)	AR(2)	AR(3)	AR(12)
(1)	0.9485	1.357	0.82%	0.9762			
			(1.86)	(103.34)			
(2)	0.9540	1.907	0.74%	1.2969	-0.3301		
			(2.47)	(34.84)	(8.71)		
(3)	0.9548	1.970	0.77%	1.3422	-0.5072	0.1367	
			(2.19)	(33.24)	(7.62)	(3.33)	
(4)	0.9554	1.973	0.69%	1.3357	-0.5155	0.1737	-0.0358
			(2.93)	(32.24)	(7.77)	(4.14)	(3.15)

In both of these tables, the numbers in parentheses are the t-Statistics corresponding to the individual parameter estimates. For both sample periods the row (4) estimate has the highest adjusted R^2 and a Durbin-Watson statistic that is close to 2, indicating no serial correlation in the regression residuals. As a consequence, the reported t-Statistics can be relied on. In particular, both of the estimates of the long-run NDR are significantly different from zero at more than a 99 percent level of confidence.

One could argue that the estimate over the shorter time period is appropriate because it eliminates the period in which the Federal Reserve attempted to target growth in monetary aggregates rather than the Federal Funds rate. A counter argument would point out that the same reasoning would call for the elimination of the period prior to November 2008 when the Federal Reserve first adopted quantitative easing as a policy tool, or that there is nothing to distinguish one estimate from the other in terms of their overall quality. Additionally, while the range of the NDR for the pre-1983 excluded observations is higher than the values reached over most of the subsequent period, the differences from the most recent observations are not as great.

Neither of these arguments are convincing, which leads to the question of what the impact of using one estimate to forecast the NDR is compared to the other. A comparison of the two forecasts appears in Figure 3A below. While the forecast based on the shorter sample period reaches its lower long-run value roughly 1.5 years sooner, the impact is not that material: the cumulative present value of $1,000 per month for 30 years is only 3.7 percent higher using the lower of the two long-run NDR forecasts. Given that risk adjustments to future losses would likely increase with time, in practice the difference would be even smaller.

Finally, even though the NDR based on the start-of-period 10-year Treasury is not stationary, it is instructive to examine the corresponding model estimates for both sample periods. The estimates for the 1979M12 to 2025M06 sample period are presented below:

Physicians' Services NDR

Based on Start-of-Period 10-Year Treasury

(Sample 1979M12 2025M06 -- 547 Observations)

	Adj R^2	DW Statistic	LR NDR	AR(1)	AR(2)	AR(3)	AR(12)
(1)	0.9825	1.364	1.45%	0.9906			
			(0.97)	(196.03)			
(2)	0.9843	1.864	1.66%	1.3068	-0.3189		
			(1.49)	(45.22)	(11.37)		
(3)	0.9849	1.962	1.53%	1.3725	-0.5888	0.2066	
			(1.13)	(46.46)	(13.02)	(7.16)	
(4)	0.9852	1.969	1.73%	1.3720	-0.5965	0.2400	-0.0284
			(1.68)	(45.75)	(12.39)	(6.96)	(2.96)

The estimates based on the 1983M01 to 2025M06 sample period appear below:

Physicians' Services NDR

Based on Start-of-Period 10-Year Treasury

(Sample 1983M01 2025M06 -- 510 Observations)

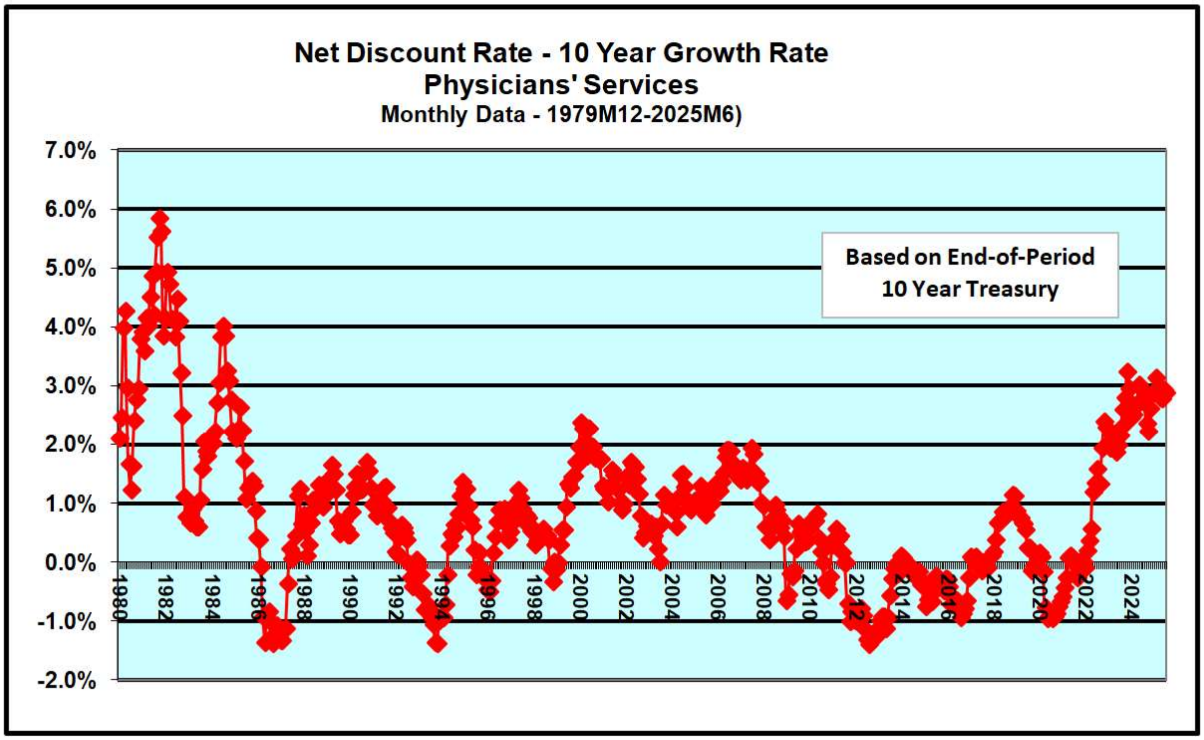
	Adj R^2	DW Statistic	LR NDR	AR(1)	AR(2)	AR(3)	AR(12)
(1)	0.9773	1.382	1.16%	0.9920			
			(1.04)	(264.84)			
(2)	0.9795	1.876	1.65%	1.3026	-0.3147		
			(2.10)	(43.93)	(10.83)		
(3)	0.9803	1.968	1.35%	1.3663	-0.5783	0.2033	
			(1.36)	(45.14)	(12.41)	(6.86)	
(4)	0.9805	1.976	1.77%	1.3656	-0.5853	0.2346	-0.0283
			(2.43)	(44.43)	(11.76)	(6.59)	(2.86)

Again, in both of these tables, the numbers in parentheses are the t-Statistics corresponding to the individual parameter estimates and, for both sample periods, the row (4) estimate has the highest adjusted R^2. The Durbin-Watson statistics indicate no serial correlation in the regression residuals, suggesting the reported t-Statistics could be relied on ***if the NDRs were stationary***. A comparison of the two forecasts appears in Figure 3B below. While the forecasts are very close to each other, the difference with Figure 3A is substantial. The results in these tables and figures highlight the necessity of addressing the stationarity question first – jumping to estimation of a forecasting equation can lead to erroneous results.

Conclusion

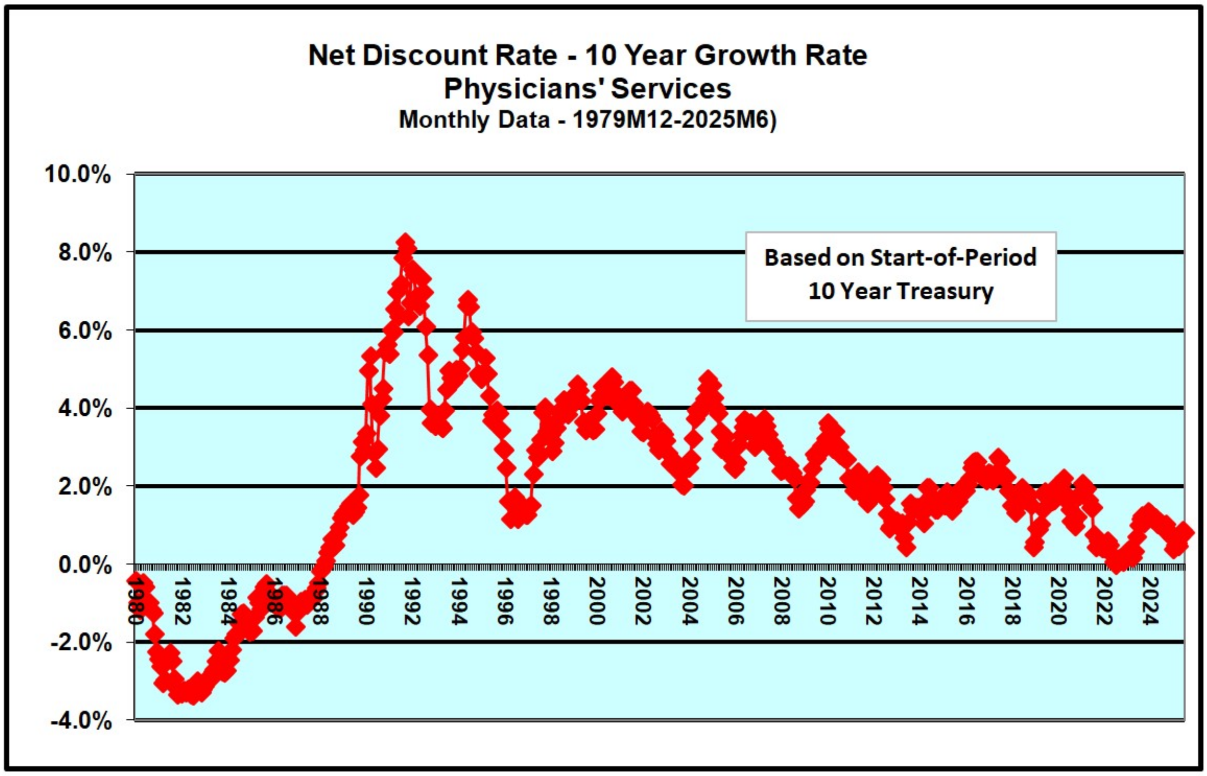
The main conclusion of this appendix is that testing for stationarity is a complex process that starts with examination of the data through time and of the correllogram of the series in question. Additionally, more than one formal statistical test should be utilized, rather than relying on just one. Finally, the ordinary-least-squares estimate of ρ and it standard error in the equation $Y_t = \alpha + \rho \cdot Y_{t-1} + \varepsilon_t$, with both the estimate of ρ and its standard error corrected for bias, should be examined. Once the stationarity of the NDR has been satisfactorily established, a suitable autoregressive model should be estimated and used to forecast the NDR into a future. It is important that the FE not jump to this phase of the process. Likewise, the FE should be wary of picking a sample period designed to generate some desired result, *e.g.* a high long-run NDR for defenses reports and a low long-run NDR for plaintiff reports.

Figure 1A – Physicians' Services NDR (Based on End-of-Period 10-Year Treasury Rate)



	Covariance	Correlation	NOB	t-Statistic
1979M12 thru 2025M06	0.00087	0.92412	547	56.46
1983M1 thru 2025M6	0.00067	0.92367	510	54.33

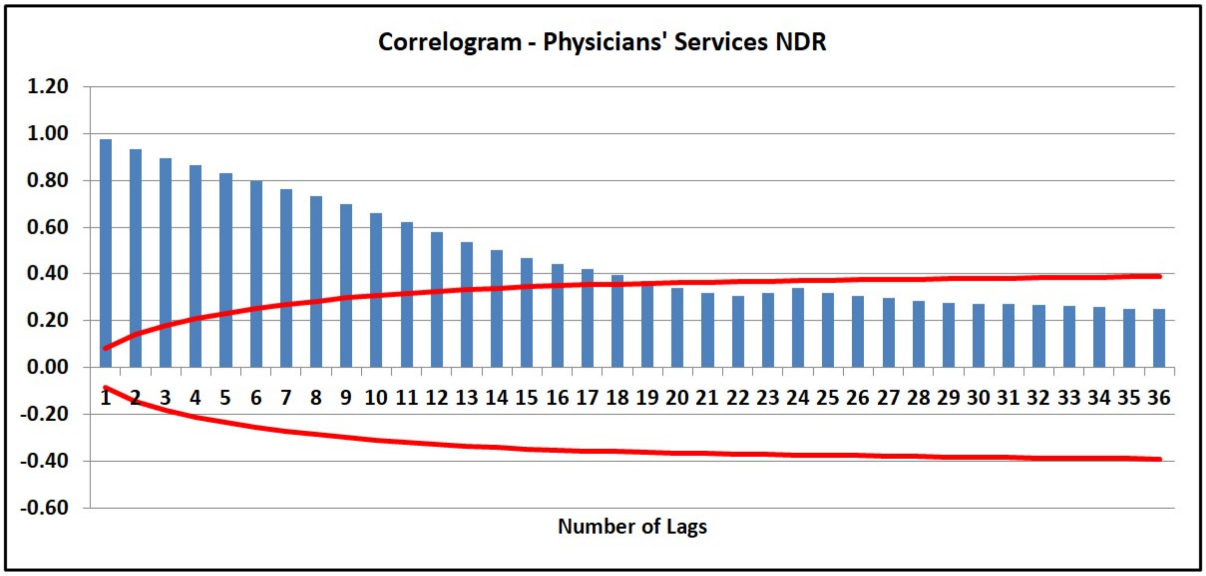
Figure 1B – Physicians' Services NDR (Based on Start-of-Period 10-Year Treasury Rate)



	Covariance	Correlation	NOB	t-Statistic
1979M12 thru 2025M06	0.00052	0.63692	547	19.29
1983M1 thru 2025M6	0.00057	0.71995	510	23.38

Figure 2A – Correllograms for Physicians' Services NDR
(Based on End-of-Period 10-Year Treasury Rate)

1979M12 – 2025M06



1983M01 – 2025M06

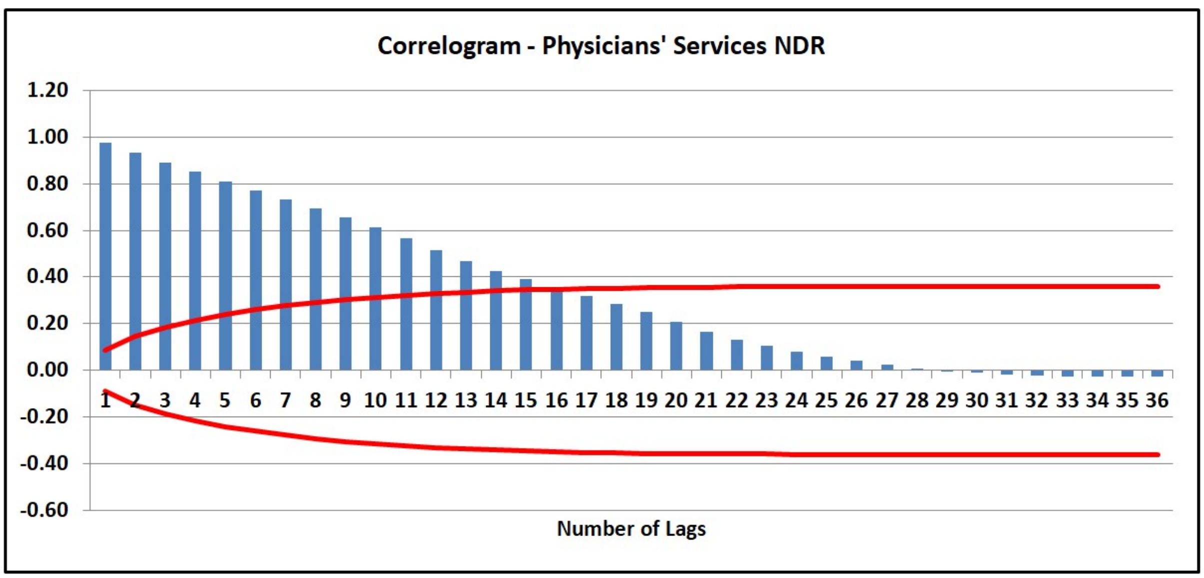
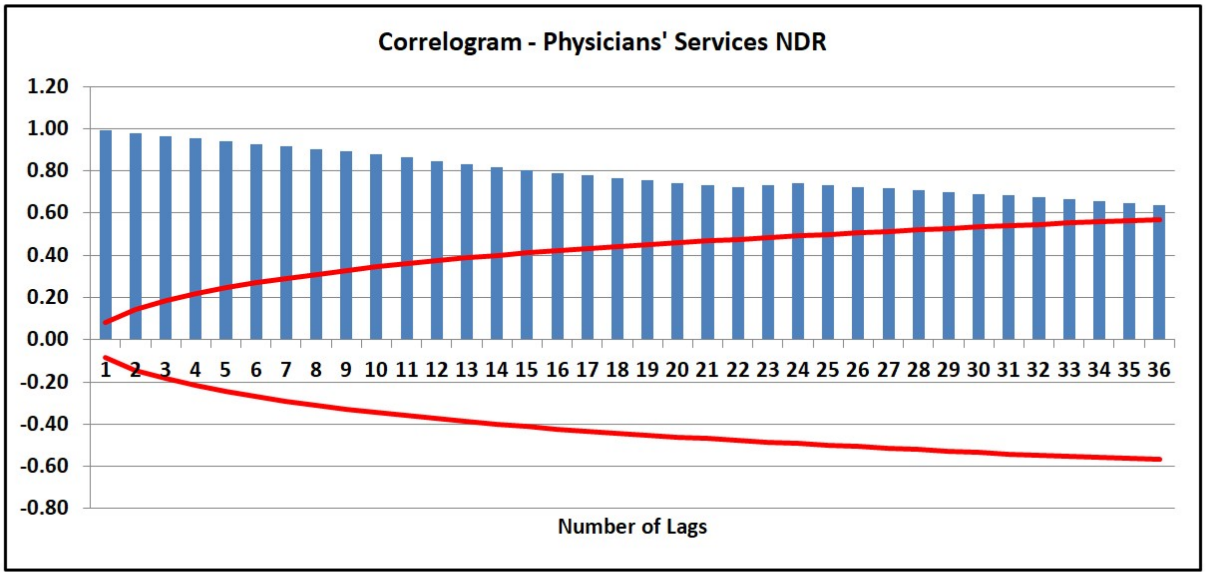


Figure 2B – Correllograms for Physicians' Services NDR
(Based on Start-of-Period 10-Year Treasury Rate)

1979M12 – 2025M06



1983M01 – 2025M06

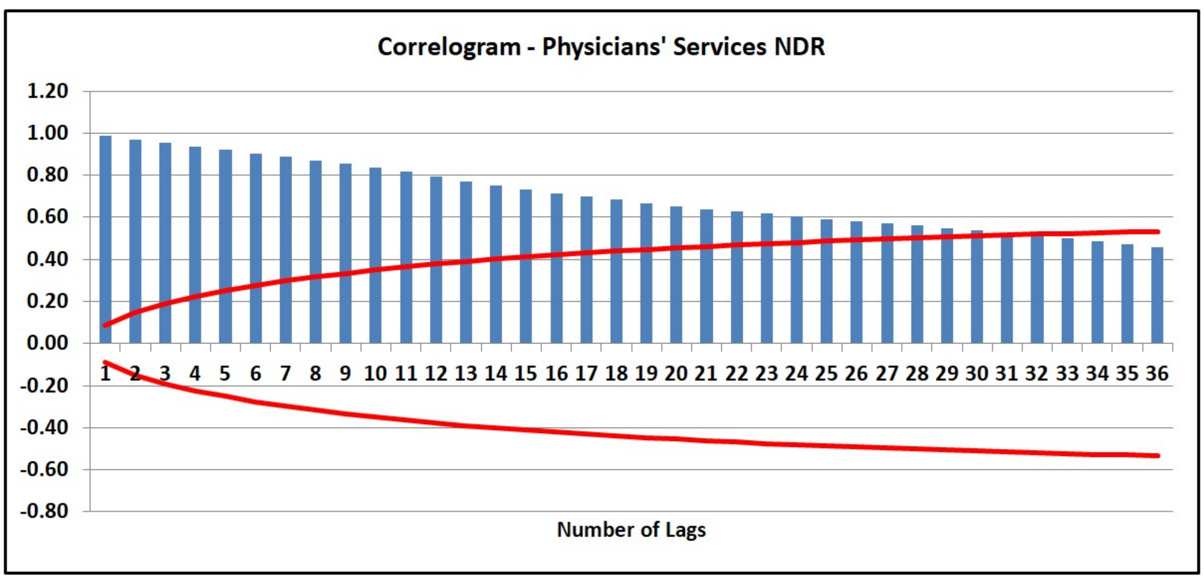


Figure 3A – Comparison of the Forecasted Net Discount Rate (Based on End-of-Period 10-Year Treasury.)

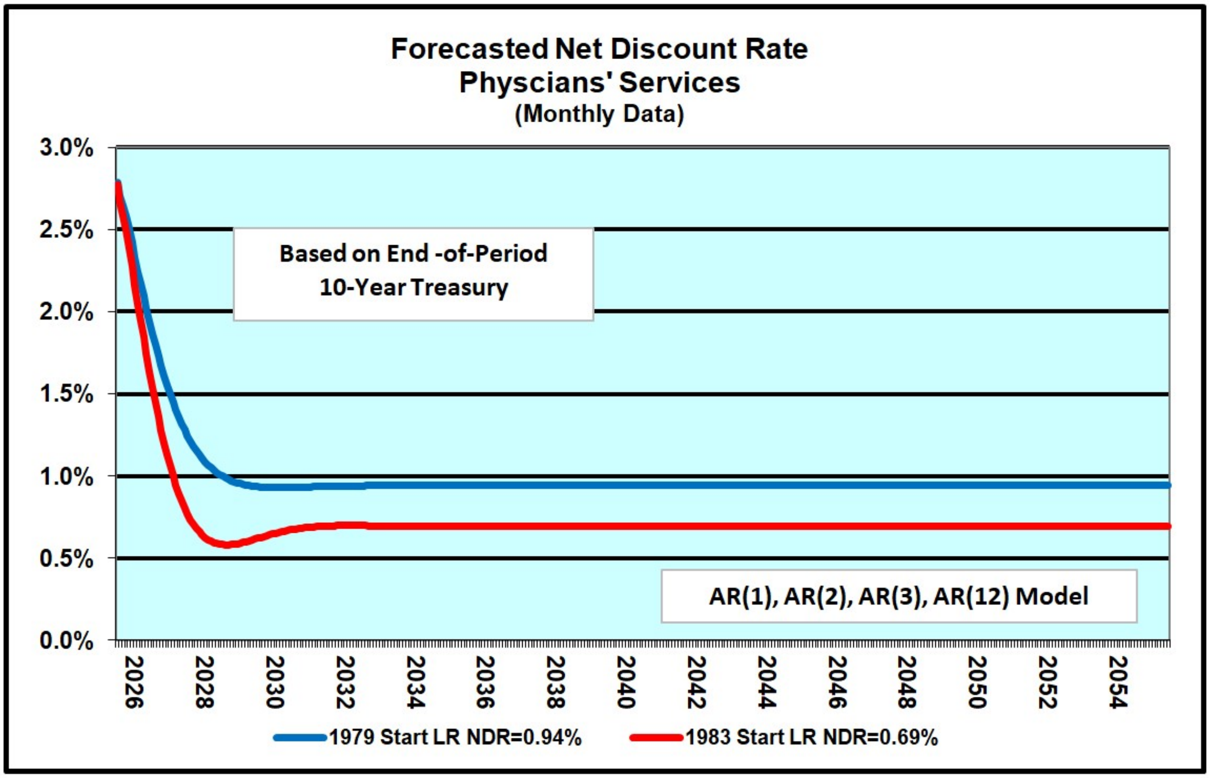


Figure 3B – Comparison of the Forecasted Net Discount Rate (Based on Start-of-Period 10-Year Treasury.)